

DESCRIPTION

RECORD CONTROL APPARATUS AND RECORD CONTROL METHOD

5 Technical Field

The present invention relates to a record control apparatus, and a record control method and, in particular, to a record control apparatus and a record control method for adjusting a size of a video object to perform seamless  
10 connection between chapters, and a program for causing a computer to perform the method.

Background Art

Optical disks recording moving image (video) data and  
15 audio data attract attention as a recording medium. The optical disks are used not only as media of contents commodity, such as movies, but also as write media allowing users to write data thereon. Known as standards of the write media are DVD-R standards that permit data to be  
20 recorded in the same region one time only, and DVD-RW standards that permit data to be written repeatedly. Known as a file format of the optical media is DVD-Video standard for replay-only disk. A write operation in compliance with the DVD-Video standard can be performed on even the write  
25 media.

In accordance with the DVD-Video standard, a maximum of 99 titles can be recorded on a per disk basis. Each title can contain a maximum of 99 chapters (PTT: Part of Title). When a recording operation is performed on each of the DVD-R  
5 and the DVD-RW using a camcorder (for camera and recorder), a single record unit from the start of recording to the end of the recording is recorded as a chapter. The data is thus recorded under the same title until a predetermined condition is satisfied. The predetermined condition to end  
10 the title is satisfied, for example, when a disk is ejected (discharged), when 99 chapters are reached under the same title, when 99 cells are reached under the same title, or when a recording mode is shifted from moving image recording to still image recording.

15 When the data recorded by the unit of chapter is played back, a slight gap takes place between chapters, and an image displayed appears momentarily interrupted. The record unit of the camcorder ranges typically from dozens of seconds to several tens of seconds, and playback interrupted  
20 at each connection between the record units is not preferable.

Seamless connection techniques for connecting video streams in a seamless manner have been proposed (for example, Japanese Examined Patent Application Publication No. 9-  
25 163300 (Fig. 1)).

In accordance with the disclosed technique, discrete images, each not reaching a minimum edit unit, are first moved to and collected on a semiconductor memory in order to play back images distributed over a plurality of different locations on an optical disk, and the discrete images thus  
5 collected are transferred to a new recording region on the optical disk. In this way, the minimum edit unit that permits seamless playback is established.

If a new recording region is set up as in the disclosed  
10 technique, data is stored on the optical disk in a duplicate manner, leading to a low recording efficiency. In particular, when data is recorded by chapter, the number of connection points in need of seamless connection is large, and it is unrealistic to set up recording regions for all  
15 connection points.

It is an object of the present invention to provide a record control apparatus that produce a video object having a size sufficient to perform seamless connection between chapters.

20

#### Disclosure of Invention

To overcome the above-described drawback, a record control apparatus of an invention (1) includes a buffer for storing moving image data belonging to a chapter, storage  
25 size detecting means for detecting that the moving image

data stored in the buffer increases in size beyond a first size and then reaches a second size, final data detecting means for detecting that the final moving image data belonging to the chapter is stored in the buffer, and moving  
5 image object output means for retrieving a portion of the moving image data, stored in the buffer, corresponding to the first size from the head of the moving image data, and outputting the portion of the moving image data as a moving image object if it is detected that the moving image data  
10 stored in the buffer reaches the second size, and retrieving the whole moving image data stored in the buffer and outputting the retrieved moving image data as a moving image object if it is detected that the final moving image data belonging to the chapter is stored in the buffer. Even  
15 immediately after the moving image data corresponding to the first size is retrieved from the buffer, the moving image object of the second size for seamless connection between chapters is acquired.

In the record control apparatus of an invention (2) in  
20 accordance with the invention (1), the storage size detecting means includes size measurement means for measuring the size of the moving image data stored in the buffer, time measurement means for measuring time by converting, into time, the size of the moving image data  
25 stored in the buffer, and threshold detecting means for

detecting that the time measurement means detects the second size after the size measurement means detects the first size. With this arrangement, the first size is measured based on the size of the moving image data, and the second size is  
5 measured by converting the size of the moving image data into time. The video object having the second size corresponding to time for seamless connection between chapters is acquired.

In the record control apparatus of an invention (3) in  
10 accordance with the invention (2), the storage size detecting means further includes threshold holding means for holding the first size and the second size and supplying the threshold detecting means with the first size and the second size. With this arrangement, the threshold in the storage  
15 size detecting means can be set to any value.

The record control apparatus of an invention (4) in accordance with the invention (3), further includes threshold setting means for setting the first size of the moving image object as a standard size of the moving image  
20 object, and the second size of the moving image object as a lower limit value of the moving image object for seamless connection in the threshold holding means. With this arrangement, threshold values are set in accordance with the standard size of the moving image object and the lower limit  
25 value of the moving image object for seamless connection.

In the record control apparatus of an invention (5) in accordance with the invention (1), the moving image object output means includes packing means for dividing the moving image data retrieved from the buffer into packs, each pack  
5 having a fixed length, and multiplexing means for multiplexing the packed moving image data and outputting the multiplexed moving image data as the moving image object. With this arrangement, a moving image object in accordance with the DVD-Video standard is generated.

10 An encoding system of an invention (6) includes moving image encoding means for encoding a moving image signal and outputting the encoded moving image signal as moving image data, audio encoding means for encoding an audio signal and outputting the encoded audio signal as audio data, a buffer  
15 for storing the moving image data belonging to a chapter, storage size detecting means for detecting that the moving image data stored in the buffer increases in size beyond a first size and then reaches a second size, final data detecting means for detecting that the final moving image  
20 data belonging to the chapter is stored in the buffer, moving image object output means for retrieving a portion of the moving image data, stored in the buffer, corresponding to the first size from the head of the moving image data, multiplexing, as a moving image object, the retrieved  
25 portion of the moving image data and the audio data, and

outputting the moving image object if it is detected the size of the moving image data stored in the buffer reaches the second size, and retrieving the whole moving image data stored in the buffer, multiplexing, as a moving image object, 5 the retrieved moving image data and the audio data, and outputting the moving image object if it is detected that the final moving image data belonging to the chapter is stored in the buffer. In accordance with the encoding system, the moving image object of the second size for 10 seamless connection between chapters is acquired in the encoding system even immediately after the moving image data corresponding to the first size is retrieved from the buffer.

A record control method of an invention (7) of a record control apparatus having a buffer storing moving image data 15 belonging to a chapter, includes a step of encoding the moving image data and outputting successively the encoded moving image data to the buffer, a step of detecting that the moving image data stored in the buffer increases in size beyond a first size and then reaches a second size, a step 20 of retrieving a portion of the moving image data, stored in the buffer, corresponding to the first size from the head of the moving image data, and outputting the retrieved portion of the moving image data as a moving image object if it is detected that the size of the moving image data stored in 25 the buffer reaches the second size, a step of detecting that

the final moving image data belonging to the chapter is stored in the buffer, and a step of retrieving the whole moving image data stored in the buffer and outputting the retrieved moving image data as a moving image object if it  
5 is detected that the final moving image data belonging to the chapter is stored in the buffer. In accordance with the recording method, the moving image object of the second size for seamless connection between chapters is acquired even immediately after the moving image data corresponding to the  
10 first size is retrieved from the buffer.

A record control method of an invention (8) a record control apparatus having a buffer storing moving image data belonging to a chapter, includes a step of setting a first size of the moving image object as a standard size of a  
15 moving image object, and a second size of the moving image object as a lower limit value of the moving image object for seamless connection, a step of encoding the moving image data and outputting successively the encoded moving image data to the buffer, a step of detecting that the moving  
20 image data stored in the buffer increases in size beyond the first size and then reaches the second size, a step of retrieving a portion of the moving image data, stored in the buffer, corresponding to the first size from the head of the moving image data, and outputting the retrieved portion of  
25 the moving image data as a moving image object if it is



detected that the size of the moving image data stored in the buffer reaches the second size, a step of detecting that the final moving image data belonging to the chapter is stored in the buffer, and a step of retrieving the whole  
5 moving image data stored in the buffer and outputting the retrieved moving image data as a moving image object if it is detected that the final moving image data belonging to the chapter is stored in the buffer. In accordance with the record control method, threshold values are set in response  
10 to the standard size of the moving image object and the lower limit value of the image object for seamless connection, and the moving image object of the second size for seamless connection between chapters is acquired even immediately after the moving image data corresponding to the  
15 first size is retrieved from the buffer.

A program of an invention (9) for causing a computer to perform a record control method of a record control apparatus having a buffer storing moving image data belonging to a chapter, includes a step of encoding the  
20 moving image data and outputting successively the encoded moving image data to the buffer, a step of detecting that the moving image data stored in the buffer increases in size beyond a first size and then reaches a second size, a step of retrieving a portion of the moving image data, stored in  
25 the buffer, corresponding to the first size from the head of

the moving image data, and outputting the retrieved portion of the moving image data as a moving image object if it is detected that the size of the moving image data stored in the buffer reaches the second size, a step of detecting that the final moving image data belonging to the chapter is stored in the buffer, and a step of retrieving the whole moving image data stored in the buffer and outputting the retrieved moving image data as a moving image object if it is detected that the final moving image data belonging to the chapter is stored in the buffer. In accordance with the program, the moving image object of the second size for seamless connection between chapters is acquired even immediately after the moving image data corresponding to the first size is retrieved from the buffer.

15 A program of an invention (10) for causing a computer to perform a record control method of a record control apparatus having a buffer storing moving image data belonging to a chapter, includes a step of setting a first size of the moving image object as a standard size of a moving image object, and a second size of the moving image object as a lower limit value of the moving image object for seamless connection, a step of encoding the moving image data and outputting successively the encoded moving image data to the buffer, a step of detecting that the moving image data stored in the buffer increases in size beyond the

first size and then reaches the second size, a step of  
retrieving a portion of the moving image data, stored in the  
buffer, corresponding to the first size from the head of the  
moving image data, and outputting the retrieved portion of  
5 the moving image data as a moving image object if it is  
detected that the size of the moving image data stored in  
the buffer reaches the second size, a step of detecting that  
the final moving image data belonging to the chapter is  
stored in the buffer, and a step of retrieving the whole  
10 moving image data stored in the buffer and outputting the  
retrieved moving image data as a moving image object if it  
is detected that the final moving image data belonging to  
the chapter is stored in the buffer. In accordance with the  
program, threshold values are set in response to the  
15 standard size of the moving image object and the lower limit  
value of the moving image object for seamless connection,  
and the moving image object of the second size for seamless  
connection between chapters is acquired even immediately  
after the moving image data corresponding to the first size  
20 is retrieved from the buffer.

The present invention provides a record control  
apparatus that assures a video object having a size required  
for seamless connection between chapters.

25 Brief Description of the Drawings

Fig. 1 illustrates an encoding system in accordance with an embodiment of the present invention.

Fig. 2 illustrates a data structure in accordance with DVD-Video standard.

5 Fig. 3 illustrates a data structure in accordance with one embodiment of the present invention;

Fig. 4 illustrates a record control apparatus 300 in accordance with one embodiment of the present invention;

10 Fig. 5 illustrates a change in storage size of a video stream buffer 310 along time axis.

Fig. 6 illustrates a structure of a storage size detector 330 in accordance with one embodiment of the present invention.

15 Fig. 7 illustrates operation of an encoding system in accordance with one embodiment of the present invention.

#### Best Mode for Carrying Out the Invention

The embodiments of the present invention are described in detail below with reference to the drawings.

20 Fig. 1 illustrates an encoding system in accordance with one embodiment of the present invention. The encoding system includes a video encoder 100 for encoding a moving image signal, an audio encoder 200 for encoding an audio signal and outputting the encoded audio signal as audio data,  
25 a recorder controller 300 for multiplexing outputs of the

video encoder 100 and the audio encoder 200, a recorder 400  
for recording stream data, multiplexed by the recorder  
controller 300, onto a recording medium 490, an encoder  
controller 500 for controlling operation of the video  
5 encoder 100, the audio encoder 200, the recorder controller  
300, and the recorder 400, and a system bus 600 for  
interconnecting these elements.

The video encoder 100 encodes a moving image signal  
supplied via a signal line 101, and supplies the encoded  
10 moving image data to a signal line 199. The audio encoder  
200 encodes an audio signal supplied via a signal line 201  
and supplies the encoded audio data to a signal line 299.  
The recorder controller 300 multiplexes the moving image  
data and the audio data, respectively supplied via the  
15 signal lines 199 and 299, into stream data in a data  
structure in compliance with the DVD-Video standard, and  
supplies the stream data to a signal line 399. The recorder  
400 records the stream data, supplied via the line 399, onto  
a recording medium 490 in compliance with the DVD-Video  
20 standard.

The encoder controller 500 includes a processor 510, a  
ROM 520, a RAM 530, an input/output interface 540, and a bus  
550 for mutually interconnecting these elements. The  
processor 510 controls encoding of the moving image signal  
25 and the audio signal and start and stop of recording to the

recording medium 490 while monitoring the progress of encoding in the video encoder 100 and the audio encoder 200. The ROM 520 stores a program executed by the processor 510, and a variety of parameters, and includes an EPROM such as a flash memory. The RAM stores job data required for the execution of the program, and includes an SRAM or DRAM, for example. The input/output interface 540 exchanges data with the outside, and is used to issues an instruction to start or stop recording to the recording medium 490, and to update the program in the ROM 520.

Fig. 2 illustrates a data structure complied with the DVD-Video standard. The recording space of the recording medium 490, if viewed in a radial direction across the disk, is divided into a lead-in area 801, a file management area 802, a data recording area 803, and a lead-out area 804 in the order from inner to outer circles of the disk.

The file management area 802 includes a UDF (Universal Disc Format) zone, and a VMG (Video ManaGer) zone from the side of the lead-in area. The UDF zone and the VMG zone serve as a recording area recording management information of files, such as image data recorded on a DVD. The UDF zone supports UDF standards and ISO 9660 standards, thereby allowing a computer to read the DVD. The VMG zone serves as a recording area recording DVD management information.

The data recording area 803 records the moving image

signal and the audio signal. The data recording area 803 records data according to a unit of data groups called a video title set (VTS) 811. Each video title set 811 is composed of video title set information (VTSI) 821, video  
5 title set menu (VTSM\_VOBS: Video Object Set for the VTSM) 822, video title set title (VTSTT\_VOBS: Video Object Set for Title in a VTS) 823, and backup (VTSI(BUP): Back-Up of VTSI) 824.

The video title set information (VTSI) 821 is control  
10 information for a video title set. The video title set menu (VTSM\_VOBS) 822 is a content for a variety of menus in the video title set. The video title set title (VTSTT\_VOBS) 823 is a content for playing back a title. The backup (VTSI(BUP)) 824 is a backup copy of the video title set  
15 information 821.

The video title set title (VTSTT\_VOBS) 823 holds an object set containing at least one video object (VOB) 831. The video object (VOB) 831 includes at least one cell 841. The cell 841 includes at least one video object unit (VOBU)  
20 851. The VOB 851 contains a moving image signal corresponding to one GOP (group of picture), and an audio signal corresponding thereto. One of MPEG-2 system and MPEG-1 is used to encode the moving image signal. One of AC-3, linear PCM, and MPEG Audio is used to encode the audio  
25 signal.

The video object unit VOB 851 is composed of a plurality of packs 861. Each pack 861 is composed of at least one packet. In this example, one pack contains one packet. More specifically, one pack contains a pack header 871 ahead of a packet, and the packet. The packet contains a packet header 872 and packet data 873 as data body. The DVD-Video standard specifies that one pack is 2048 bytes (corresponding to one sector). The moving image signal and the audio signal are encoded, and then divided into packs before being stored.

Fig. 3 illustrates one example of data structure in accordance with the embodiment of the present invention. The moving image data encoded by the video encoder 100 is divided into a GOP (group of pictures) composed of image frames. In this example, one GOP 700 is composed of 15 frames of unit image (B1 through P15).

One frame of image is classified as one of I picture (Intra-picture), P picture (Predictive picture), and B picture (Bidirectionally predictive picture). The I picture is obtained by encoding data within a frame in the same sequential order as the original image. The P picture, namely a forward-predicted frame, is obtained by encoding data in the same sequential order as the original image. One GOP contains at least one picture.

In a unit image 710, I3 represents an I picture, and



each of B1, B2, B4, B5, B7, B8, B10, B11, B13, and B14  
represents a B picture, and each of P6, P9, P12, and P15  
represents a P picture. A suffixed number of each designate  
is a serial number of a frame unit and unrelated to the  
5 picture type.

A B picture is a bidirectionally-predicted frame. After  
an I picture and a P picture are encoded, the B picture is  
encoded and inserted between the encoded I picture and the  
encoded P picture. The B picture is thus encoded in a  
10 sequential order different from the original image. For  
this reason, the B picture is rearranged to come behind the  
I picture and the P picture, both of which are referenced  
during the bidirectionally predictive coding. In a unit  
image 720 subsequent to the rearrangement, B1 and B2 are  
15 arranged behind I3, and B4 and B5 are arranged behind P6.

The unit image 720 thus produced is packed into a VOB  
730. In the present embodiment, one VOB corresponds to one  
GOP. Alternatively, one VOB may contain two GOPs. A  
navigation pack 31 (NV\_PCK) is arranged at the head of each  
20 VOB. The navigation pack holds playback management  
information (such as control information indicating a sector  
to jump to).

A pack group 732 (V\_PCK\_13) holds the moving image data  
corresponding to the unit image I3. The size of one pack is  
25 2048 bytes. If the size of the moving image data is above

2048 bytes, the moving image data is divided into a plurality of packs for storage. A pack 733 (A\_PCK1) holds the audio data. A pack group 734 (V\_PCK\_B1) holds the moving image data corresponding to the unit image B1.

5        Fig. 4 illustrates one example of the recorder controller 300 in accordance with the embodiment of the present invention. The recorder controller 300 includes a video stream buffer 310, an audio stream buffer 320, a storage size detector 330, a final data detector 340, a  
10 video packer 350, an audio packer 360, and a multiplexer 390.

      The video stream buffer 310 stores the moving image data supplied to the signal line 199 from the video encoder 100. The audio stream buffer 320 stores the audio data supplied to the signal line 299 from the audio encoder 200.  
15 The video stream buffer 310 and the audio stream buffer 320 work on a first-in first-out (FIFO) basis, and outputs data from outputs terminals thereof in the order of input sequence.

      The storage size detector 330 detects the size of the moving image data stored in the video stream buffer 310.  
20 Upon detecting that the moving image data stored in the video stream buffer 310 via the signal line 199 reaches a predetermined size, the storage size detector 330 so notifies the video packer 350 and the audio packer 360 via  
25 the signal line 399.

The final data detector 340 detects that the final moving image data belonging to a chapter is stored in the video stream buffer 310. The final data detector 340 learns the end of the chapter in response to the reception of a  
5 record stop instruction from the processor 510. Upon detecting that the final moving image data of the chapter is stored in the video stream buffer 310, the final data detector 340 so notifies the video packer 350 and the audio packer 360 via a signal line 349.

10 The video packer 350 retrieves the moving image data from the video stream buffer 310 to generate a video pack. Upon being notified by the storage size detector 330 via the signal line 339 that the moving image data stored in the video stream buffer 310 reaches the predetermined size, the  
15 video packer 350 retrieves, from the video stream buffer 310, moving image data smaller in size than the predetermined size to generate a video pack. Upon being notified by the final data detector 340 via the signal line 349 that the final moving image data of the chapter is stored in the  
20 video stream buffer 310, the video packer 350 retrieves the whole moving image data stored in the video stream buffer 310 to generate a video pack.

The audio packer 360 retrieves the audio data from the audio stream buffer 320 to generate an audio pack. Upon  
25 being notified by one of the storage size detector 330 and

the final data detector 340 of the above-described event,  
the audio packer 360 retrieves the audio data from the audio  
stream buffer 320, along with the moving image data  
retrieved from the video stream buffer 310, to generate the  
5 audio pack.

The multiplexer 390 multiplexes the video pack  
generated by the video packer 350 and the audio pack  
generated by the audio packer 360, thereby outputting a VOB.  
The multiplexer 390 is composed of a VOB generator 370 and  
10 a VOB generator 380. The VOB generator 370 attaches a  
navigation pack of Fig. 3 to each of the video pack and the  
audio pack, thereby generating a VOB. The VOB generator  
380 combines the VOB generated by the VOB generator 370,  
thereby generating a VOB.

15 Fig. 5 illustrates a chronological change in the  
storage size of the data in the video stream buffer 310 in  
accordance with the embodiment of the present invention. In  
Fig. 5, the ordinate represents a chronological change in  
the storage size of the data in the video stream buffer 310  
20 and the abscissa represents time. The moving image data is  
input to the video stream buffer 310 at a predetermined  
speed (of 9.3 Mbps, for example). The stored moving image  
data is retrieved bit by bit by a predetermined amount of  
data at a time in response to an instruction from one of the  
25 storage size detector 330 and the final data detector 340.

For convenience of explanation, the retrieval of the data is assumed to be performed instantaneously.

For example, a standard size of the VOB is 6 Mbytes, and the data is retrieved from the video stream buffer 310 by 6 Mbytes as a predetermined amount of size at a time. The data retrieval is now performed as soon as data of 6 Mbytes is stored in the video stream buffer 310. If the chapter ends soon, the size of the final VOB can be small with almost no moving image data remaining in the video stream buffer 310. In accordance with the embodiment of the present invention, the data retrieval is performed when moving image data of a predetermined duration of time is stored after the data of 6 Mbytes is stored in the video stream buffer 310.

With one VOBU corresponding to one GOP, one VOBU is converted into a duration of time equal to 15 frames/29.97 Hz $\approx$ 0.5005 second in NTSC (National Television Standards Committees). To assure the final VOB of the chapter equivalent to 1.5 seconds as one condition to perform seamless connection, at least three VOBUs are contained in one VOB. The retrieval is performed when three VOBUs as moving image data of a predetermined duration of time are stored after the moving image data stored in the video stream buffer 310 increases beyond 6 Mbytes.

In this arrangement, three VOBUs remain in the video

stream buffer 310 even immediately after the moving image data of 6 Mbytes is retrieved from the video stream buffer 310. Even if the chapter ends immediately subsequent to the retrieval of the moving image data of 6 Mbytes, a size of  
5 the final VOB equivalent to 1.5 seconds or more is assured.

Fig. 6 illustrates the structure of the storage size detector 330 in accordance with the embodiment of the present invention. The storage size detector 330 includes a size counter 331, a time counter 332, a threshold holder 333,  
10 and a threshold detector 334.

The size counter 331 monitors the moving image data input to the video stream buffer 310 via the signal line 199, thereby measuring the size of the moving image data stored in the video stream buffer 310. Upon detecting that the  
15 size of the moving image data stored in the video stream buffer 310 increases beyond a predetermined size, the size counter 331 so notifies the threshold detector 334 via a signal line 336. As shown in Fig. 5, if the size of the moving image data increases beyond 6 Mbytes, the size  
20 counter 331 so notifies the threshold detector 334 via the signal line 336.

The time counter 332 monitors the moving image data that is input to the video stream buffer 310 via the signal line 199. After the size of the moving image data stored in  
25 the video stream buffer 310 increases beyond a predetermined

size (6 Mbytes), the time counter 332 measures the size of the moving image data stored in the video stream buffer 310 by converting the size of the moving image data into time. When the time converted size exceeds a predetermined

5 duration of time, the time counter 332 so notifies the threshold detector 334 via a signal line 338. The time counter 332 is notified by the threshold detector 334 via a signal line 337 as shown in Fig. 5 that the moving image data increases beyond a predetermined amount, namely, 6

10 Mbytes. Upon detecting that three VOBUs (about 1.5 seconds) as the predetermined duration of time is stored, the time counter 332 so notifies the threshold detector 334 via the signal line 338.

The threshold holder 333 holds, as threshold values,

15 the predetermined size in the size counter 331 and the predetermined duration of time in the time counter 332. These threshold values are set by the encoder controller 500.

Upon detecting that a measurement value of the size counter 331 increases beyond the predetermined size (6

20 Mbytes) of the threshold holder 333, the threshold detector 334 causes the time counter 332 via the signal line 337 to start measurement. Upon detecting that the measurement value of the time counter 332 increases beyond the predetermined time (3 VOBUs) of the threshold holder 333,

25 the threshold detector 334 issues instructions via the

signal line 339 to cause the video packer 350 and the audio packer 360 to retrieve data from the video stream buffer 310 and the audio stream buffer 320, respectively. In response to the instruction via the signal line 339, the  
5 size counter 331 subtracts the predetermined size (6 Mbytes) from the measurement value, and the time counter 332 resets the measurement value thereof to zero.

The encoding system of the embodiment of the present invention is described below with reference to the drawings.

10 Fig. 7 illustrates operation of the encoding system in accordance with the embodiment of the present invention. When the start of chapter recording is instructed using a button or the like in the encoding system, the instruction is transferred to the entire system via the input/output  
15 interface 540. The video encoder 100 and the audio encoder 200 starts encoding (step S912). The moving image data encoded by the video encoder 100 is stored in the video stream buffer 310, and the moving image data encoded by the audio encoder 200 is stored in the audio stream buffer 320.  
20 Prior to the storage of the data, the threshold holder 333 sets the predetermined size and the predetermined duration of time as the threshold values (step S911).

When a stop instruction for stopping the chapter recording is issued by a button (not shown) or the like, the  
25 instruction is transferred to the entire encoding system via



the input/output interface 540. In response to the record stop instruction (step S913), the final data detector 340 detects that the final data of the chapter is stored in the video stream buffer 310, and causes the video packer 350 to  
5 pack the moving image data remaining in the video stream buffer 310 as the final VOB of the chapter (step S919). The packed moving image data is organized as the VOB by the VOB generator 370 and the VOB generator. The recorder 400 then records the VOB onto the recording medium 490.

10       Until the chapter record stop instruction is issued, the storage size detector 330 monitors the size of the moving image data stored in the video stream buffer 310. Upon detecting (step S914) that the moving image data increases beyond the predetermined size (6 Mbytes) and then  
15 reaches the predetermined duration of time (3 VOBUs), the video packer 350 packs the moving image data of the predetermined size (6 Mbytes), stored in the video stream buffer 310, from the head thereof (step S915). The packed moving image data is organized into the VOB by the VOB  
20 generator 370 and the VOB generator, and is then recorded onto the recording medium 490 by the recorder 400.

      In accordance with the embodiment of the present invention, the storage size detector 330 measures the size of the moving image data stored in the video stream buffer  
25 310, and when it is detected that the moving image data

increases beyond the predetermined size and then reaches the predetermined duration of time, the moving image data of the predetermined size is retrieved from the video stream buffer 310. The time-converted final VOB of the recorded chapter  
5 is used to assure the predetermined duration of time.

In accordance with the embodiment of the present invention, the NTSC is used as a moving image playback system. PAL method having a frame frequency of 25 Hz may also be equally used. In this case, one VOB is converted  
10 into 15 frames/25 Hz=0.6 second. Three VOBs assures 1.8 seconds. If one GOP is composed of 12 frames, 14 frames/25 Hz=0.48 second. Four VOBs assures 1.92 seconds. The measurement threshold of the threshold holder 333 may be set to 4 VOBs.

15 In the discussion of the embodiment of the present invention, the elements of the recorder controller 300 are implemented in hardware. Alternatively, the recorder controller 300 may be implemented in hardware and/or software. For example, programs may be stored in one of the  
20 ROM 520 and the RAM 530 in the encoder controller 500, and the processor 510 performs the above-referenced function.

The embodiment of the present invention has been discussed for exemplary purposes only. Elements in the embodiment correspond to elements in the claim as is  
25 discussed below. The present invention is not limited the

correspondence, and a variety of changes is possible without departing from the scope of the present invention.

In the invention (1), the buffer corresponds to the video stream buffer 310. The first size corresponds to the predetermined size (6 Mbytes in the example of Fig. 5). The  
5 second size corresponds to the predetermined time-converted size (3 VOBUs of Fig. 5). The storage size detecting means corresponds to the storage size detector 330. The final data detecting means corresponds to the final data detector  
10 340. The moving image object output means corresponds to the video packer 350 and the multiplexer 390.

In accordance with the invention (2), the size measurement means corresponds to the size counter 331. The time measurement means corresponds to the time counter 332.  
15 The threshold detecting means corresponding to the threshold detector 334.

In accordance with the invention (3), the threshold holding means corresponding to the threshold holder 333.

In accordance with the invention (4), the threshold  
20 setting means corresponds to the processor 510.

In accordance with the invention (5), the packing means corresponds to the video packer 350. The multiplexing means corresponds to the multiplexer 390.

In accordance with the invention (6), the moving image  
25 encoding means corresponds to the video encoder 100. The

audio encoding means corresponds to the audio encoder 200.  
The buffer corresponds to the video stream buffer 310. The  
first size corresponds to the predetermined size (6 Mbytes  
in the example of Fig. 5). The second size corresponds to  
5 the predetermined time-converted size (3 VOBUs of Fig. 5).  
The storage size detecting means corresponds to the storage  
size detector 330. The final data detecting means  
corresponds to the final data detector 340. The moving  
image object output means corresponds to the video packer  
10 350 and the multiplexer 390.

In accordance with the invention (7) or (9), step S912  
corresponds to the step of encoding the moving image data  
and outputting successively the encoded moving image data to  
the buffer. Step S914 corresponds to the step of detecting  
15 that the moving image data stored in the buffer increases in  
size beyond a first size and then reaches a second size.  
Step S915 corresponds to the step of retrieving a portion of  
the moving image data, stored in the buffer, corresponding  
to the first size from the head of the moving image data,  
20 and outputting the retrieved portion of the moving image  
data as a moving image object if it is detected that the  
size of the moving image data stored in the buffer reaches  
the second size. Step S913 corresponds to the step of  
detecting that the final moving image data belonging to the  
25 chapter is stored in the buffer. Step S919 corresponds to

the step of retrieving the whole moving image data stored in the buffer and outputting the retrieved moving image data as a moving image object if it is detected that the final moving image data belonging to the chapter is stored in the  
5 buffer.

In accordance with the invention (8) or (10), step S911 corresponds to the step of setting the first size of the moving image object as a standard size of a moving image object, and the second size of the moving image object as a  
10 lower limit value of the moving image object for seamless connection. Step S912 corresponds to the step of encoding the moving image data and outputting successively the encoded moving image data to the buffer.

Step S914 corresponds to the step of detecting that the  
15 moving image data stored in the buffer increases in size beyond a first size and then reaches a second size. Step S915 corresponds to the step of retrieving a portion of the moving image data, stored in the buffer, corresponding to the first size from the head of the moving image data, and  
20 outputting the retrieved portion of the moving image data as a moving image object if it is detected that the size of the moving image data stored in the buffer reaches the second size. Step S913 corresponds to the step of detecting that the final moving image data belonging to the chapter is  
25 stored in the buffer. Step S919 corresponds to the step of

retrieving the whole moving image data stored in the buffer and outputting the retrieved moving image data as a moving image object if it is detected that the final moving image data belonging to the chapter is stored in the buffer.

5       The procedure discussed with reference to the embodiment of the present invention may be considered as a method for performing a series of steps, a program for causing a computer to perform the series of steps, or a recording medium storing the program.

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#### Industrial Applicability

The present invention is applicable to the encoding of a moving image signal into MPEG format moving signal, and the writing of the MPEG format moving image signal onto a

15   DVD.